

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Expanding the Economic and Innovation)	GN Docket No. 12-268
Opportunities of Spectrum Through Incentive)	
Auctions)	

COMMENTS OF ALCATEL-LUCENT

Alcatel-Lucent submits these Comments in response to the Public Notice released May 17, 2012 in the above captioned proceeding seeking to supplement the record on the 600 MHz band plan in connection with upcoming incentive auctions authorized by the Middle Class Tax Relief and Job Creation Act of 2012.

I. BACKGROUND

Alcatel-Lucent applauds the efforts of Commission Staff and industry stakeholders working through the policy and technical issues surrounding voluntary incentive auctions. Through this collaborative effort, much progress has been made toward reaching consensus. As the Public Notice recognizes, there is wide support for variations on a “Down from 51” band plan,¹ similar to the “exemplary” Frequency Division Duplex (“FDD”) band plan offered by Alcatel-Lucent.² The Public Notice further correctly recognizes that commenters favor the Down from 51 approaches in part because they minimize operation of TV Broadcast channels interspersed with wireless services, in contrast to the Commission’s

¹ Public Notice at 1-2.

² See Comments of Alcatel-Lucent at Figure 2; *see also* Appendix A, attached.

“split” FDD band plan it proposed in the Notice of Proposed Rulemaking (“NPRM”).³ There is also wide agreement that, in an FDD-focused band plan, the Commission should maximize paired spectrum where technically feasible.⁴ The proposed Time Division Duplex (“TDD”) band plan similarly would flow “down from 51.”⁵

The Wireless Telecommunications Bureau now seeks further information on band plan variations with a focus on a “Down from 51 Reversed” band plan, which has not been supported in the record to date, and to enhance the record further on the Down from 51 FDD approaches that previously have been detailed in the record and on a TDD approach.

II. BAND PLAN COMPARISON

In these Comments, Alcatel-Lucent provides a comparison of four band plan approaches: (1) the newly proposed Down from 51 Reversed band plan; (2) the Exemplary FDD band plan proposed in our Comments; (3) an FDD band plan with 7 uplink and 7 downlink blocks (“7 UL/7DL FDD”); and (4) a TDD band plan. Appendix A to these comments includes charts depicting each of these band plans and how they would change to accommodate varying degrees of clearing and repacking across geographic markets. These Comments focus exclusively on issues of spectral efficiency and band plan variability, and do not review the other technical aspects regarding the advantages and disadvantages of FDD versus TDD band plans or among the various FDD approaches with different pass band sizes.

A. Baseline Assumptions for Comparison

A rigorous review of band plan variability and efficiency favors the FDD Down from 51 band plans that include upper 600 MHz uplink adjacent to lower 700 MHz

³ See *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, *Notice of Proposed Rulemaking*, 27 FCC Rcd 12357 (2012).

⁴ See Comments of Alcatel-Lucent at 13; Comments of AT&T Inc. at Figure 4; Verizon Comments at 14.

⁵ See Public Notice at 6; Comments of Sprint Nextel Corporation at 22.

uplink as well as a TDD band plan over the new Down from 51 Reversed proposal. In order to compare the several band plan proposals in any meaningful way, it is essential to go through the steps of lining up 5 MHz wireless blocks, adding any necessary guard bands, leaving Channel 37 in place, and (for FDD) including a uniform nationwide duplex gap. The challenge becomes even more intricate because of the interplay between 6 MHz TV channels and 5 MHz or 10 MHz wireless blocks. As markets become more constrained, the effect of reintroducing TV channels into the band plan is not always intuitive. The effort to apply numbers to these diverse band plans brought into sharp focus the level of difficulty involved in crafting *any* 600 MHz band plan to provide maximum variability and maximum utility.

Alcatel-Lucent's analysis assumes a fixed duplex gap of 10 MHz and a 10 MHz guard band between wireless downlink operations and TV operations.⁶ The analysis similarly assumes a 10 MHz guard band between 700 MHz wireless uplink services and (i) upper 600 MHz downlink for Down from 51 Reversed or (ii), in the alternative, upper 600 MHz TDD. In all cases, there are numerous judgment calls and variations at each plan variation, particularly in the placement of "round-off spectrum" arising from the mismatch of the 5 and 6 MHz rasters. Our analysis attempts to focus on the variation that puts the band plan in the best light possible, including a preference for interchangeable blocks and paired spectrum where feasible.

The analysis at Appendix A presumes that handset filters cover multiple wireless blocks and limit the flexibility for incrementally narrowing downlink blocks in 5 MHz increments. For example, if a filter covers a 20 MHz span (i.e., 4 downlink blocks), a TV station introduced less than a guard band away from the edge of that span would cause harmful interference across the entire 20 MHz span, not just the 5 MHz downlink wireless carrier that the TV Station overlaps. Our analysis does not place such strict limits on uplink

⁶ This analysis does not differentiate between TV channels operating at 1 MW versus those operating at a lower power.

flexibility due to the greater ability to engineer solutions into wireless base stations to mitigate TV Broadcast interference compared to the capabilities of user equipment.⁷

Importantly, for an FDD band plan, Alcatel-Lucent assumes here that there *will need to be* television stations in the duplex gap (more precisely, within the pass band above the duplex gap) in constrained markets in order to maximize the amount of spectrum made available in those markets. The proposals set forth in Appendix A ensure that TV channels are limited and are surrounded by sufficient guard bands to protect wireless operations.

Alcatel-Lucent holds to its assertion that it would be undesirable to build a band plan that routinely inserts multiple TV channels in the duplex gap even in unconstrained markets, as was assumed in the Commission's split FDD band plan proposal. However, in constrained markets, retaining some TV channels above the duplex gap is necessary to maximize band plan efficiency.

B. Traditional Down From 51 FDD Band Plans and the TDD Band Plan Maximize Spectral Efficiency Compared to the Reverse Band Plan

Appendix A to these Comments reviews the numerous market scenarios from 120 MHz (20 channels) cleared down to the most constrained markets where much less spectrum is cleared. By using consistent technical assumptions, as discussed above, we attempt to provide an "apples to apples" comparison.

The Down from 51 Reversed band plan starts at a disadvantage with respect to spectral efficiency because it must have both guard band separation from 700 MHz uplink (which FDD proposals with uplink at the high end of the 600 MHz band do not) *and* must include a duplex gap (which a TDD band plan does not). Each of the other variations compared in Appendix A make available more overall wireless spectrum for 120 MHz

⁷ In a TDD band plan, this phenomena results in certain TDD carriers being rendered uplink only. See Appendix A.

cleared than would the Down from 51 Reversed plan. For instance, the Exemplary FDD band plan provides the potential for 9 pairs with 120 MHz cleared, while the Down from 51 Reversed Plan provides for 8 pairs. A TDD band plan similarly offers nine 10 MHz blocks.⁸

Where the Down from 51 Reversed plan presents greatest concerns, however, is in moderately constrained markets. The drop in the much-prized paired spectrum in favor of supplemental downlink blocks (“SDL”) is particularly precipitous. Even at 96 MHz cleared (16 channels), the Down from 51 Reversed plan only offers 4 pairs (plus 4 SDL blocks), the least paired spectrum of the proposals we analyze here. The Exemplary FDD plan offers 5 pairs, the 7UL/7DL FDD plan provides 7 pairs, and the TDD band plan similarly provides seven 10 MHz blocks.

At 12 channels cleared, the analysis yields 4 pairs for the Down from 51 Reverse band plan, but one must introduce TV channels above the duplex gap to offer that many pairs, which the Commission’s Public Notice does not appear to contemplate. In contrast, the Exemplary FDD band plan easily accommodates 5 pairs at 12 channels cleared and TDD similarly provides five 10 MHz blocks. The 7 UL/7DL FDD plan yields 4 pairs.

At 11 channels cleared and below the number of pairs becomes very limited for all FDD plans. The Down from 51 Reversed Plan offers zero pairs, the Exemplary FDD plan offers 1 pair, and the 7 UL/7DL FDD plan offers 2 pairs. The TDD example yields four 10 MHz blocks. It is only in most constrained markets that the Down from 51 Reversed plan arguably succeeds over other FDD band plans. At 48 MHz cleared, for example, the Down from 51 Reversed band plan offers 4 SDL blocks while the other FDD plans offer only unpaired uplink. TDD provides two 10 MHz blocks.

In sum, in our comparison of FDD plans, the traditional Down from 51 band plans are more spectrally efficient above 60 MHz cleared than the Down from 51 Reversed

⁸ To aid in comparing band plan efficiency, these comments equate a 10 MHz TDD block to a 5 MHz plus 5 MHz FDD pair.

plan. The Down from 51 Reversed band plan only becomes more spectrally efficient than other FDD plans between 42 and 48 MHz cleared, when the Reversed band plan continues to offer SDL blocks and other FDD plans offer only unpaired uplink. A TDD band plan provides a roughly comparable number of 10 MHz spectrum blocks as the FDD paired spectrum blocks of the Exemplary FDD and 7UL/7DL FDD band plans at most larger clearing levels. At the lowest clearing levels, the TDD band plan fairs relatively well.

III. MARKET VARIABILITY IS DESIRABLE, BUT REQUIRES FURTHER STUDY

As the Bureau recognizes in the Public Notice, concerns have been raised in the record with respect to accommodating market variation due to the potential for co-channel interference between wireless and broadcast TV operations in adjacent markets.⁹ Alcatel-Lucent agrees with the Bureau that market variability is important to unlocking maximum 600 MHz spectrum nationwide. To that end, Alcatel-Lucent continues to work with other industry stakeholders to study the challenges of co-channel interference between TV stations and wireless operations in adjacent markets and potential solutions to mitigate those challenges.

In the Public Notice, the Bureau addresses concerns that more than 200 km distances may be required to guard against interference by countering that “the United States is more than an order of magnitude larger than those distances.”¹⁰ Alcatel-Lucent respectfully disagrees that that answers the question. Rather, the issue is that constraints in one market can cause a daisy chain effect, where interference from TV stations operating in Market A might constrain Market B, which might constrain Market C, and so on. Early analysis indicates that terrain may be sufficient to mitigate this interference in some markets, but that such terrain may not be present in others. This issue appears acute along the densely

⁹ Public Notice at 2-3 & n.17.

¹⁰ *Id.* at n.17.

deployed U.S. eastern seaboard. In short, at least with respect to some geographic regions, there may not be practical engineering solutions that would allow maximum variability on a market by market basis.

In conjunction with technical analysis of required separation distances and terrain, Alcatel-Lucent encourages the Commission to consider auction design solutions that can facilitate variability. For example, it may be possible to create artificial geographic inflexion points to increase market variation. To illustrate this concept, assume only 10 channels can be cleared in Market A which would constrain Markets B through F to a band plan based on only 10 channels cleared due to co-channel interference. Also assume that Markets B through F would otherwise clear 14 channels if not for the limitations caused by Market A. Depending on available software tools and auction design capabilities, the Commission could identify where the daisy chain problem is likely to exist to constrain variability and, turning again to the example of Markets A through F, choose a market in the chain to clear 14 TV channels but operate a 10 channels cleared wireless band plan. This would create a “fire break” that could isolate a constrained market, freeing up greater amounts of spectrum in other markets, increasing overall auction revenues and benefitting consumers.

IV. CONCLUSION

For the foregoing reasons, Alcatel-Lucent urges against the Commission to continue to work with stakeholders on band plan solutions to maximize spectral efficiency, achieve market variability and address co-channel interference concerns.

Respectfully submitted,

Alcatel-Lucent

/s/

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